Remarks

The present amendment responds to the Official Action dated February 12, 2007. A petition for a one month extension and authorization to charge our credit card the one month extension fee of $120 accompany this amendment. The Official Action rejected claims 1, 3, 4 and 46 under 35 U.S.C. 103(a) based on Kato et al. U.S. Patent No. 6,805,015 (Kato). Claims 4-8 were rejected on the ground of nonstatutory obviousness-type double patenting over claims 1-9 of Noda et al. U.S. Patent No. 6,955,156 (Noda). These grounds of rejection are addressed below following a brief discussion of the present invention to provide context. Claims 2 and 9-45 have been previously canceled. Claims 1, 3-8 and 46 are presently pending.

Claim 1

As an initial matter, the language underlined in Exhibit A has been added to claim 1. As that language was part of the claim as originally filed and was deleted as a result of an error in retyping the claims, it is not shown in claim 1 as an amendment thereto. If this change to return claim 1 to its original wording should be presented or noted in some other way, please call the undersigned to discuss it and we will proceed as directed.

The Present Invention

One aspirator approach is discussed In the Background at length at page 1, line 20-page 2, line 15 as follows:

"When the DME fuel remaining in the injection system of the DME fuel supply device after stopping the engine is retrieved into a tank by suction means such as an aspirator, it is possible to prevent abnormal combustion such as knocking at the next start of the engine caused

by the DME fuel remaining in the injection system after stopping the engine. The aspirator does not suck the DME fuel using a suction force source such as a pump but creates a circulating flow of DME fuel using an injection pump for delivering DME fuel as a driving source and sucks the DME fuel by a suction force created by the flow of DME fuel.

However, it is difficult to suck all the DME fuel remaining in the injection system of the DME fuel supply device after stopping the engine into the tank with suction means such as an aspirator within a short period of time. This is because evaporated DME fuel cannot be effectively sucked since the suction force of the aspirator is weak and since communication between the injection system and the fuel tank is shut off when the engine is stopped and the injection system is almost hermetically closed. That is, the DME fuel remaining in the injection system of the DME fuel supply device cannot be entirely retrieved before the DME fuel remaining in the injection system of the DME fuel supply device is entirely evaporated by residual heat of the engine or naturally.

Thus, it takes some time to retrieve the DME fuel remaining in the injection system of the DME fuel supply device entirely. It is, hence, impossible to retrieve the DME fuel remaining in the injection system of the DME fuel supply device entirely when the engine is stopped for a short period of time such as during idling stop at a signal crossing in an urban area, and abnormal combustion such as knocking may occur when the engine is restarted."

As further discussed at page 3, lines 18-22, the present "invention has been made in view of the above circumstances, and an object of this invention is to reduce the time to retrieve DME

fuel in the fuel injection system of a DME fuel supply device for a diesel engine after stopping the diesel engine."

The Art Rejections

As addressed in greater detail below, Kato does not support the Official Action's reading of it and the rejections based thereupon should be reconsidered and withdrawn. Further, the Applicant does not acquiesce in the analysis of Kato made by the Official Action and respectfully traverses the Official Action's analysis underlying its rejections.

Turning to claim 1, claim 1 is repeated below with the symbols used in one illustrated embodiment added thereto:

1. A DME fuel supply device for a diesel engine having:

a feed pump (50 for pressurizing DME fuel in a fuel tank (4) to a specified pressure and delivering it into a feed pipe (52);

an injection pump for delivering DME fuel in a fuel gallery (11) into which the DME fuel delivered via the feed pipe (52) flows in a specified amount to an injection pipe communicated with a fuel injection nozzle (32) of the diesel engine at specified timing;

an overflow fuel pipe (8, 9) for returning DME fuel overflowed from the fuel injection nozzle (32) and DME fuel overflowed from the injection pump 1 to the fuel tank (4); and

residual fuel retrieving means (7, 41) for retrieving DME fuel remaining in the fuel gallery (11) and the overflow fuel pipe (8, 9) after stopping the diesel engine into the fuel tank (4);

the DME fuel supply device comprising:

a vapor-phase pressure delivery pipe (73) connecting an inlet of the fuel gallery (11) to which the feed pipe (52) is connected and a vapor phase (4a) in the fuel tank (4); and

a vapor-phase pressure delivery pipe switching solenoid valve (75) for opening and closing the vapor-phase pressure delivery pipe (73).

Described at page 4, line 17-page 5, line 1 and page 40, line 30-page 41, line 32, several advantages flow from this claimed combination of features as discussed further below.

With reference to page 4, line 17-page 5, line 1, when the vapor-phase pressure delivery pipe switching solenoid valve is opened after stopping the diesel engine, the vapor phase in the fuel tank and the inlet of the fuel gallery are communicated with each other via the vapor-phase pressure delivery pipe and the pressure of the vapor phase in the fuel tank is transmitted into the fuel gallery. The vapor phase in the fuel tank has a pressure higher than that in the fuel gallery since the DME fuel vaporizes. Thus, the DME fuel in a liquid state remaining in the fuel gallery and the overflow fuel pipe can be forcibly delivered under pressure to the residual fuel retrieving means by the pressure of the vapor phase in the fuel tank.

According to the claimed DME fuel supply device for a diesel engine of claim 1, the first aspect, the DME fuel in a liquid state remaining in the fuel gallery and the overflow fuel pipe can be forcibly delivered under pressure to the residual fuel retrieving means by the pressure of the vapor phase in the fuel tank. It is, therefore, possible to achieve the advantageous result effect that the time necessary for the residual fuel retrieving means to

retrieve the DME fuel remaining in the fuel gallery and the overflow fuel pipe into the fuel tank can be reduced.

With reference to page 40, line 30-page 41, line 32, in a non-injection state, in other words, while the diesel engine 200 is stopped, the three-way solenoid valve 71 is controlled to be OFF to form a communication passage in the direction indicated by the arrow B, and the two-way solenoid valve 72 is controlled to be ON to communicate the overflow fuel pipe 8 and the overflow fuel pipe 9 with the suction port 7c of the aspirator 7 in the direction indicated by the arrow C. Then, DME fuel delivered from the feed pump 5 is delivered not to the injection pump 1 but to the aspirator 7, passed from the inlet 7a to the outlet 7b, returned to the fuel tank 4 via the cooler 41 and delivered again from the feed pump 5 to the aspirator 7. That is, the DME fuel is circulated via the aspirator 7. Then, DME fuel remaining in the fuel gallery in the injection pump 1, the overflow fuel pipe 8 and the overflow fuel pipe 9 is evaporated, and the evaporated DME fuel is sucked through the suction port 7c by the flow of the DME fuel flowing from the inlet 7a to the outlet 7b and retrieved into the fuel tank 4.

At the same time, the vapor-phase pressure delivery pipe switching solenoid valve 75 is controlled to be ON and opened so that flow can pass through the vapor-phase pressure delivery pipe 73 connecting the vapor phase 4a in the fuel tank 4 and the inlet of the fuel gallery 11. The DME fuel in the fuel tank 4 is separated into a vapor phase 4a in a vapor state and a liquid phase 4b in a liquid state. Since DME fuel vaporizes at room temperature, the DME fuel in the fuel tank 4 evaporates and forms a vapor phase 4a with a high pressure.

Thus, when the vapor phase 4a and the fuel gallery 11 in the injection pump 1 are

communicated with each other, the DME fuel in a liquid state remaining in the fuel gallery 11, the overflow fuel pipe 8 and the overflow fuel pipe 9 is delivered under pressure toward the suction port 7c of the aspirator 7 by the high pressure of the vapor phase 4a. Also, since the pressure is further increased by the small-diameter portion 74 of the vapor-phase pressure delivery pipe 73, where the inside diameter is partially reduced, the DME fuel is delivered under a higher pressure. As previously described, the suction force of the aspirator 7 can only suck evaporated DME fuel at most. Thus, the time necessary to retrieve the DME fuel remaining in the fuel gallery 11, the overflow fuel pipe 8 and the overflow fuel pipe 9 can be significantly reduced by delivering the DME fuel in a liquid state to the suction port 7c of the aspirator 7 using the pressure of the vapor phase 4a.

As is clear from the above description from the specification, the invention of claim 1 is characterized in that the vapor phase 4a in the fuel tank 4 and the inlet of the fuel gallery 11 to which the feed pipe 52 is connected are communicated via the "vapor-phase pressure delivery pipe 73 (having a vapor-phase pressure delivery pipe switching solenoid valve 75)."

By opening the switching solenoid valve 75 after stopping the diesel engine, the pressure of the vapor phase 4a in the fuel tank 4 is caused to act on the inside of the fuel gallery 11, through the vapor-phase pressure delivery pipe 73. In this way, it is possible to achieve the effect that the DME fuel in a liquid state remaining in the fuel gallery 11, can be effectively retrieved to the fuel tank 4.

That is, the pressure acts on the inside of the fuel gallery 11, via the "vapor-phase pressure delivery pipe 73" after stopping the diesel engine, so as to reduce the time necessary

to retrieve the residual DME fuel of a liquid state to the inside of the fuel tank 4.

Also, the present invention has a further distinguishing feature in that in the case of using the aspirator 7, of which suction force is weak as described at page 2, lines 2-6, as in the embodiment as a fuel retrieving means, the pressure of the vapor phase 4a in the fuel tank 4 is added to the weak suction force of the aspirator 7 so as to reduce the retrieving time.

Turning to Kato, the object of Kato is to reduce DME fuel leaking from a high-pressure pump and to retrieve DME fuel having leaked therefrom, which is different from the above described object of the present invention which addresses an arrangement to reduce the time necessary to retrieve residual DME fuel.

As such, Kato discloses neither a "vapor-phase pressure delivery pipe" employed to achieve the above object of the present invention, nor a "vapor-phase pressure delivery pipe switching solenoid valve" for controlling the opening and closing of the vapor-phase pressure delivery pipe as claimed by claim 1 of the present invention. Accordingly, Kato does not disclose and does not suggest the above subject matter claimed by claim 1. Consequently, claim 1 is patentable over Kato.

Claim 46

Like claim 1, claim 46 includes a "vapor-phase pressure delivery pipe," and is therefore believed to be patentable over Kato for the same reasons as claim 1.

Claims 3 and 4

Assuming that claim 1 is patentable, the inventions of claims 3 and 4 of the present application are patentable therewith.

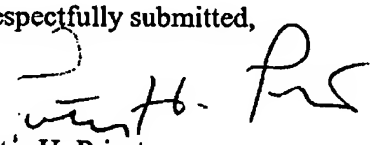
Double Patenting Nonstatutory Rejection

While applicants do not agree that there is a double patenting problem between claims 4-8 and claims 1-9 of Noda, in light of the combination features addressed in detail above, in the interest of expediting prosecution, a terminal disclaimer is filed herewith.

Conclusion

All of the presently pending claims, as amended, appearing to define over the applied references, withdrawal of the present rejection and prompt allowance are requested.

Respectfully submitted,



Peter H. Priest
Reg. No. 30,210
Priest & Goldstein, PLLC
5015 Southpark Drive, Suite 230
Durham, NC 27713-7736
(919) 806-1600

Exhibit A

1. (original) A DME fuel supply device for a diesel engine having:

a feed pump for pressurizing DME fuel in a fuel tank to a specified pressure and delivering it into a feed pipe;

an injection pump for delivering DME fuel in a fuel gallery into which the DME fuel delivered via the feed pipe flows in a specified amount to an injection pipe communicated with a fuel injection nozzle of the diesel engine at specified timing;

an overflow fuel pipe for returning DME fuel overflowed from the fuel injection nozzle and DME fuel overflowed from the injection pump to the fuel tank; and

residual fuel retrieving means for retrieving DME fuel remaining in the fuel gallery and the overflow fuel pipe after stopping the diesel engine into the fuel tank;

the DME fuel supply device comprising:

a vapor-phase pressure delivery pipe connecting an inlet of the fuel gallery to which the feed pipe is connected and a vapor phase in the fuel tank; and

a vapor-phase pressure delivery pipe switching solenoid valve for opening and closing the vapor-phase pressure delivery pipe.